

EXERCISES

For more practice, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

Example 1 (page 34)

In Exercises 1–8, draw a diagram similar to the given one. Then do the construction. Check your work with a ruler or a protractor.

1. Construct \overline{XY} congruent to \overline{AB} .

2. Construct \overline{VW} so that $VW = 2AB$.

3. Construct \overline{DE} so that $DE = TR + PS$.

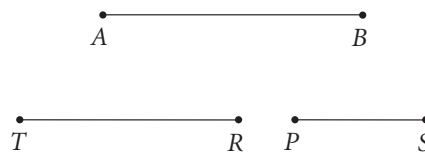
4. Construct \overline{QJ} so that $QJ = TR - PS$.

5. Construct $\angle D$ so that $\angle D \cong \angle C$.

6. Construct $\angle F$ so that $m\angle F = 2m\angle C$.

7. Construct the perpendicular bisector of \overline{AB} .

8. Construct the perpendicular bisector of \overline{TR} .

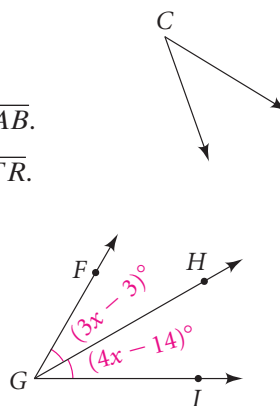


Example 2 (page 35)

Example 3 (page 36)

Example 4 (page 36)

9. **Algebra** \overrightarrow{GH} bisects $\angle FGI$.
- Solve for x and find $m\angle FGH$.
 - Find $m\angle HGI$.
 - Find $m\angle FGI$.



Algebra For Exercises 10–12, \overrightarrow{BX} bisects $\angle ABC$. Solve for x and find $m\angle ABC$.

10. $m\angle ABX = 5x$, $m\angle XBC = 3x + 10$

11. $m\angle ABC = 4x - 12$, $m\angle ABX = 24$

12. $m\angle ABX = 4x - 16$, $m\angle CBX = 2x + 6$

Example 5 (page 37)

B Apply Your Skills

13. Draw acute $\angle PQR$. Then construct its bisector.

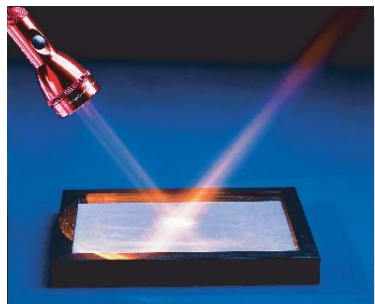
14. Draw right $\angle TUV$. Then construct its bisector.

15. Use your protractor and draw $\angle W$ with $m\angle W = 120$. Construct $\angle Z \cong \angle W$. Then construct the bisector of $\angle Z$.

Sketch the figure described. Explain how to construct it. Then do the construction.

16. $\overrightarrow{XY} \perp \overrightarrow{YZ}$

17. \overrightarrow{ST} bisecting right $\angle PSQ$

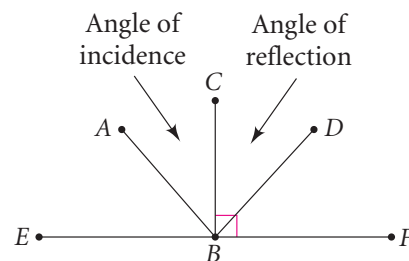


18. **Optics** A beam of light and a mirror can be used to study the behavior of light. Light that strikes the mirror is reflected so that the angle of reflection and the angle of incidence are congruent. In the diagram, \overline{BC} is perpendicular to the mirror and $\angle ABC$ has a measure of 41° .

a. Name the angle of reflection and find its measure.

b. Find $m\angle ABD$.

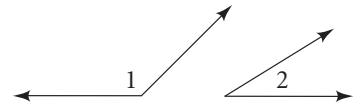
c. Find $m\angle ABE$ and $m\angle DBF$.



19. Use a straightedge and protractor.
- Draw a mirror and a light beam striking the mirror and reflecting from it.
 - Construct the bisector of the angle formed by the incoming and reflected light beams. Label the angles of incidence and reflection.
20. **Open-Ended** Snoopy can draw squares with his compass. You can only draw circles. You can, however, construct a square. Explain how to do this. Use sketches if needed. Then do the construction.
21. Answer these questions about a segment in a plane. Explain each answer.
- How many midpoints does the segment have?
 - How many bisectors does it have? How many lines in the plane are its perpendicular bisectors?
 - How many lines in space are its perpendicular bisectors?

For Exercises 22–24, copy $\angle 1$ and $\angle 2$.

22. Construct $\angle B$ so that $m\angle B = m\angle 1 + m\angle 2$.
23. Construct $\angle C$ so that $m\angle C = m\angle 1 - m\angle 2$.
24. Construct $\angle D$ so that $m\angle D = 2m\angle 2$.



25. **Reasoning** When \overrightarrow{BX} bisects $\angle ABC$, $\angle ABX \cong \angle CBX$. Lani claims there is always a related equation, $m\angle ABX = \frac{1}{2}m\angle ABC$. Denyse claims the related equation is $2m\angle ABX = m\angle ABC$. Which equation is correct? Explain.



26. **Writing** Describe how to construct the midpoint of a segment.
27. Construct a 45° angle.
28. a. Draw a large triangle with three acute angles. Construct the bisectors of the three angles. What appears to be true about the three angle bisectors?
b. Repeat the constructions with a triangle that has one obtuse angle.
c. **Make a Conjecture** What appears to be true about the three angle bisectors of any triangle?




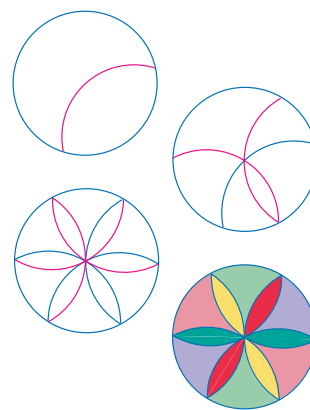
Need Help?

In Exercise 28a, your construction may suggest something but be slightly off. If so, test your conjecture very carefully in part (b).

Use a ruler to draw segments of 2 cm, 4 cm and 5 cm. Then construct each triangle, if possible. If not possible, explain.

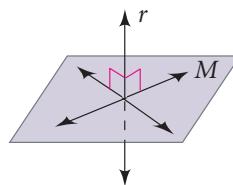
29. with 4-cm, 4-cm, and 5-cm sides 30. with 2-cm, 5-cm, and 5-cm sides
31. with 2-cm, 2-cm, and 5-cm sides 32. with 2-cm, 2-cm, and 4-cm sides
33. a. Draw a segment, \overline{XY} . Construct a triangle with sides congruent to \overline{XY} .
b. Measure the angles of the triangle.
c. **Writing** Describe how to construct a 60° angle; a 30° angle.

-  **34. Art** You can create daisy designs with a compass.
- Construct a circle. Keeping the same compass setting, put the compass point on the circle and construct an arc within the circle. The endpoints of the arc should be on the circle.
 - Keeping the same compass setting, put the compass point on each endpoint of the first arc and draw two new arcs.
 - Continue to make arcs around the circle using the endpoints of previously drawn arcs until you get a six-petal daisy.

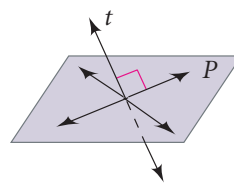


Challenge

- 35.**
- Use your compass to draw a circle. Locate three points A , B , and C on the circle.
 - Construct the perpendicular bisectors of \overline{AB} and \overline{BC} .
 - Critical Thinking** Label the intersection of the two perpendicular bisectors as point O . Make a conjecture about point O .
- 36.** Study the figures. Complete the definition of a line perpendicular to a plane:
A line is perpendicular to a plane if it is ? to every line in the plane that ?.



Line $r \perp$ plane M .



Line t is not \perp plane P .



Standardized Test Prep

Multiple Choice

- 37.** What must you do to construct the midpoint of a segment?
- | | |
|----------------------------------------|-----------------------------------------------|
| A. Measure half its length. | B. Measure twice its length. |
| C. Construct an angle bisector. | D. Construct a perpendicular bisector. |
- 38.** Which of these is the first step in constructing a congruent segment?
- | | |
|-----------------------------|--------------------------------|
| F. Draw a ray. | G. Draw a line. |
| H. Label two points. | I. Measure the segment. |

Short Response

- 39.** Explain how to do each construction using a compass and a straightedge.
- Draw an acute angle, $\angle ABC$. Construct an angle congruent to $\angle ABC$.
 - Construct an angle whose measure is twice that of $\angle ABC$.

Extended Response

- 40.** Explain how to do each construction using a compass and a straightedge.
- Divide a segment into two congruent segments.
 - Divide a segment into four congruent segments.
 - Construct a segment that is 1.25 times as long as a given segment.



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Mixed Review

Lesson 1-4

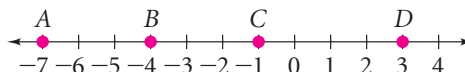
Use the number line at the right. Find the length of each segment.

41. \overline{AC}

42. \overline{AD}

43. \overline{CD}

44. \overline{BC}



45. Use a protractor to draw a 72° angle.

46. $\angle DEF$ is a straight angle. $m\angle DEG = 80$. Find $m\angle GEF$.

47. $m\angle TUV = 100$ and $m\angle VUW = 80$. Find possible values of $m\angle TUW$.

Lesson 1-3

48. Draw \overleftrightarrow{RS} .

Use your drawing from Exercise 48. Answer and explain.

49. Are \overrightarrow{RS} and \overrightarrow{SR} opposite rays?

50. Are \overline{RS} and \overline{SR} the same segment?

Geometry at Work

Cabinetmaker

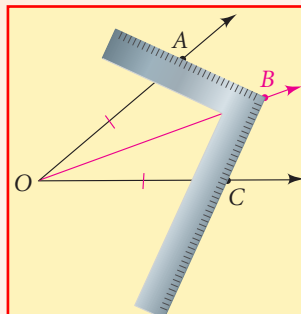
Cabinetmakers not only make cabinets but all types of wooden furniture. The artistry of cabinetmaking can be seen in the beauty and uniqueness of the finest doors, shelves, and tables. The craft is in knowing which types of wood and tools to use, and how to use them.

The carpenter's square is one of the most useful of the cabinetmaker's tools. It can be applied to a variety of measuring tasks. The figure shows how to use a carpenter's square to bisect $\angle O$.



Take It to the NET For more information about cabinetmaking, go to www.PHSchool.com.

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First, mark equal lengths OA and OC on the sides of the angle. Then position the square so that $BA = BC$ to locate point B . Finally, draw \overrightarrow{OB} . \overrightarrow{OB} bisects $\angle O$.